N60087.AR.003506
NAS BRUNSWICK
5090.3a

# FINAL TASK SPECIFIC PLAN FOR THE SITE 7 SCOPING SURVEY FORMER NAS BRUNSWICK ME

08/01/2014

TETRA TECH EC INC

**DEPARTMENT OF THE NAVY**
**NAVAL FACILITIES ENGINEERING COMMAND, ATLANTIC**
**REMEDIAL ACTION CONTRACT (RAC)**
**CONTRACT NO. N62470-13-D-8007**
**CONTRACT TASK ORDER NO. WE09**

# FINAL
# TASK-SPECIFIC PLAN FOR THE SITE 7 SCOPING SURVEY
# FORMER NAVAL AIR STATION BRUNSWICK
# BRUNSWICK, MAINE

**August 2014**

*Prepared for*

Department of the Navy
Naval Facilities Engineering Command, Mid-Atlantic
9742 Maryland Avenue, Building Z-144
Norfolk, VA 23511-3095

and

Base Realignment and Closure
Program Management Office, Northeast
4911 South Broad Street
Philadelphia, PA 19112-1303

*Prepared by*

Tetra Tech EC, Inc.
5250 Challedon Drive
Virginia Beach, VA 23462

| Revision | Date | Reviewed by | Approved by | Pages Affected |
|---|---|---|---|---|
| 0 | 8/26/14 | N. Smith | E. Abkemeier | All |

This page intentionally left blank.

# TABLE OF CONTENTS



## LIST OF TABLES



## LIST OF APPENDICES

This page intentionally left blank.

# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| µR/hr | microroentgens per hour |
| APP | Accident Prevention Plan |
| $cm^2$ | square centimeter |
| Co-60 | Cobalt-60 |
| Cs-137 | Cesium-137 |
| CTO | Contract Task Order |
| DFW | Definable Features of Work |
| DoD | Department of Defense |
| dpm | disintegrations per minute |
| DRMO | Defense Reutilization and Marketing Office |
| ELAP | Environmental Laboratory Accreditation Program |
| FSS | Final Status Survey |
| H-3 | Tritium |
| HRA | Historical Radiological Assessment |
| LLRW | low-level radioactive waste |
| MARSSIM | Multi-Agency Radiation Survey and Site Investigation Manual |
| NaI | Sodium Iodide |
| NASB | Naval Air Station Brunswick |
| NAVFAC | Naval Facilities Engineering Command |
| NAVSEA | Naval Sea Systems Command |
| Navy | United States Department of the Navy |
| Ra-226 | Radium-226 |
| RASO | Radiological Affairs Support Office |
| RWP | Radiation Work Permit |
| ROC | radionuclides of concern |
| RSOR | Radiation Safety Officer Representative |
| SOP | Standard Operating Procedure |
| Sr-90 | Strontium-90 |
| SSHP | Site Safety and Health Plan |
| SU | Survey Unit |
| Th-232 | Thorium-232 |
| TtEC | Tetra Tech EC, Inc. |
| TSP | Task-Specific Plan |
| U-238 | Uranium-238 |

This page intentionally left blank.

# 1.0 INTRODUCTION

Tetra Tech EC, Inc. (TtEC) has prepared this Task-Specific Plan (TSP) for the Site 7 Scoping Survey located at the former Naval Air Station Brunswick (NASB), Brunswick, Maine for the United States Department of the Navy (Navy), Naval Facilities Engineering Command (NAVFAC), Atlantic under a Removal Action Contract, N62470-13-D-8007, Contract Task Order (CTO) WE09. The survey will be conducted in accordance with the general approach and methodologies provided in the Basewide Radiological Management Plan (TtEC, 2014a) and Standard Operating Procedures (SOPs) provided in Attachment 3 to the Basewide Radiological Management Plan. The surveys will conform to the requirements of the Accident Prevention Plan (APP)/Site Safety and Health Plan (SSHP) (TtEC, 2013) and the Radiation Protection Plan, Attachment 2 to the Basewide Radiological Management Plan, prepared for the survey program.

This survey is being performed as a Scoping Survey to determine whether residual radioactivity is present at Site 7. The survey of this area has been designed as a Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) NUREG-1575 survey (DoD et.al, 2000). The intent of the Site 7 Scoping Survey is to achieve the requirements of a Final Status Survey (FSS) and demonstrate that the site is not radiologically impacted. In the event that no release criteria exceedances are observed during the performance of the survey and sampling activities detailed in this TSP, the Scoping Survey will be documented as a MARSSIM Class 3 FSS and will establish that Site 7 is not radiologically impacted and is therefore radiologically free released.

## 1.1 Site Description and Historical Summary

Site 7, also known as the Old Acid/Caustic Pit, was reportedly used for disposal of non-radiological hazardous liquids (acidic and caustic liquids, transformer oils, solvents, and miscellaneous liquids) between 1952 and 1969 and was also used by the Defense Reutilization and Marketing Office (DRMO) facility for outdoor storage and as an equipment laydown area between 1964 and 1974. The approximate 1.4 acre site located in the northeast portion of former NASB was remediated in 2002, which consisted of the removal of approximately 400 cubic yards of cadmium-contaminated soil. In 2001, approximately 120 cubic yards was disposed of off-site and the remaining 280 cubic yards was spread across the site in 6-inch lifts. The groundwater is currently contaminated with cadmium with land use controls in place for the soil and groundwater. The location of the Site 7 within NASB is shown on Figure A-1.

Site 7 is a flat open clearing with no current radiological use; however, as it was reported that the site was used for storage of equipment and airplane components to be surplused by the Navy, which could have been radiologically impacted, Site 7 is considered a potential for radiological impact [Naval Sea Systems Command (NAVSEA), 2014]. Per the Historical Radiological Assessment (HRA), the radionuclides of concern (ROCs) for Site 7 are Cobalt-60 (Co-60), Cesium-137 (Cs-137), Radium-226 (Ra-226), Strontium-90 (Sr-90), Thorium-232 (Th-232), Tritium (H-3), and Uranium-238 (U-238) (NAVSEA, 2014).

## 2.0 SURVEY DESCRIPTION

Prior to the start of excavation activities, the accessible areas of the approximate 1.4 acre area (approximately 5,666 square meters) will undergo a 100 percent health and safety gamma walkover survey in accordance with SOP 001, Radiation and Contamination Surveys using a Ludlum Model 19 (or equivalent) survey meter to ensure no areas exceeding 50 microroentgens per hour (μR/hr) exist. If any area exceeds 50 μR/hr, the area will be posted as a Radiologically Controlled Area, the Navy will be notified, survey activities will cease, and the site will be re-classified as a Class 1 area. A separate TSP addressing remediation of radioactively contaminated soil and items with Class 1 surveys will be developed and approved by the Navy prior to recommencing radiological survey activities. Any areas with more elevated readings will be posted in accordance with SOP 012, Radiologically Controlled Areas and Posting Control.

Upon completion of the health and safety survey confirming that no areas exceed 50 μR/hr, surface vegetation removal and clearing followed by a geophysical survey will be performed. Surface vegetation removal and clearing will be performed in a manner that does not disturb the ground surface. The two areas (Area 1 and Area 2) to be excavated to remove soil with elevated concentrations of cadmium, the source of cadmium leaching to the groundwater, as identified in the Technical Memorandum, Data Gap Investigations for Sites 1 and 3, Site 2, and Site 7 (Tetra Tech, Inc., 2012) are identified on Figure A-1 provided in Appendix A. Area 1 is located south of the former caustic pit and encompasses approximately 4,805 square feet (447 square meters) and 890 cubic yards using an average thickness of 5 feet. Area 2 is located east of the former caustic pit and encompasses approximately 1,700 square feet (158 square meters) and 252 cubic yards assuming an average thickness of 3 feet. The removal of the approximately 1,142 cubic yards of soil is being performed to address the source of cadmium exceedances of the Maine Maximum Exposure Guideline of one microgram per liter in groundwater at Site 7. The excavated soil, following radiological screening as described below, will be transported to the Sites 1/3 landfill for placement under the landfill cap (to be discussed in a separate TSP). These two areas will be marked and surveyed as two Class 3 survey units as described below.

Prior to excavation activities, 100 percent of the ground surfaces within Areas 1 and 2 will be surveyed using a Navy Radiological Affairs Support Office (RASO) approved towed array system and/or Ludlum Model 2350-1 survey meter equipped with a Ludlum Model 44-10 2-inch by 2-inch sodium iodide (NaI) detector (or equivalent) to identify areas in which discrete radioactive materials or radioactively contaminated materials may be located. The investigation level for each Class 3 survey unit will be the mean plus 3 sigma (σ) where σ is the standard deviation of the gamma readings in the survey unit. However, as a starting point for areas scan surveyed with a Ludlum Model 2350-1 survey meter with a Ludlum Model 44-10 2-inch by 2-inch NaI detector, areas will be marked (e.g., with flags) based on the mean of the reference area plus 3σ value. After a one hundred percent gamma scan of the area has been completed, the mean of the survey unit plus 3σ value investigation value will be determined. Marked areas will be reassessed based on this value. Any areas exceeding the investigation level will be further investigated through collection of a gamma static survey with a Ludlum Model 2350-1 survey meter equipped with a Ludlum Model 44-10 2-inch by 2-inch NaI detector (or equivalent). If the

static reading exceeds the investigation level, the onsite Radiation Safety Officer Representative (RSOR) will determine, based on professional judgment, whether further investigation is warranted. If site conditions (i.e., presence of material containing elevated concentrations of Naturally Occurring Radioactive Material [NORM]) are ruled out as the likely source of the elevated gamma readings, the location will be excavated by hand to a maximum depth of one foot to determine whether a discrete item or significant radiological contamination in a concentrated area may be the cause of the comparatively elevated gamma reading. If a discrete item and/or soils that exhibit elevated gamma readings are present, the items and a minimum of one foot of soil on either side and below the discrete items and/or soils that exhibit elevated gamma readings will be removed as described in a specific Radiation Work Permit. The discrete item and/or soils that exhibit elevated gamma readings will be placed in an appropriate low level radioactive waste (LLRW) bin or equivalent container for subsequent transfer to the Navy's LLRW disposal contractor. Post-remediation soil samples will be collected from the excavation sidewalls and bottom and of the removed soil if a discrete item is discovered. The excavated soil will be placed on plastic, spread out in a maximum12-inch lift, resurveyed, and a biased soil sample will be collected from the area with the most elevated gamma readings. Any items removed from the soil will be surveyed in accordance with SOP 003, Release of Materials and Equipment from Radiologically Controlled Areas and analyzed in accordance with SOP 015, Use Of The Berkeley Nucleonics Corporation SAM-940-3G Radioisotope Identifier or an equivalent radioisotopic identifier. If no discrete item is located in an area exceeding the investigation level, a soil sample will be collected from the area with the most elevated gamma readings. The excavated ground surface will be resurveyed to confirm the remaining soil meets the investigation level. Survey area preparation activities will be performed under radiological controls established in the SOPs provided in the Basewide Radiological Management Plan (TtEC, 2014a). In the event any discrete item exceeds any release criteria, the survey operations will cease, the Navy will be notified and the Site 7 area will be re-classified as a Class 1 area. A separate TSP addressing remediation of radioactively contaminated soils and items with a subsequent Class 1 survey unit FSS will be developed and approved by the Navy prior to recommencing survey operations. This process is repeated in Section 3.3 of this TSP.

Upon completion of the walkover survey, the top one-foot thick layer of soil from each of the two removal areas will be removed and stockpiled on plastic, bermed, and covered in accordance with the Environmental Protection Plan and Stormwater Pollution Prevention Plan. Note that the survey results of lifts at depth may affect the potential for these soil piles to require further investigation for potential radioactive contamination. After the first one-foot thick layer of soil has been removed, the soil (ground) surfaces will undergo another 100 percent gamma walkover survey using a Ludlum Model 2350-1 survey meter equipped with a Ludlum Model 44-10 2-inch by 2-inch NaI detector (or equivalent) using the same methods previously described for the survey of the surface and repeated in Section 3.3 of this TSP.

Upon completion of the walkover survey of the first lift, the next one-foot thick layer of soil will be removed and stockpiled on plastic and bermed. This process of performing walkover gamma surveys followed with soil removal will continue until the limits of the excavation as specified in the Technical Memorandum, Data Gap Investigations for Sites 1 and 3, Site 2, and Site 7 (Tetra Tech, Inc. 2012) are reached (approximately 5 feet below ground surface for Area 1 and 3 feet

below ground surface for Area 2). Each lift of soil removed will be segregated from one another to minimize the generation of LLRW, if encountered. Dewatering will be performed, as necessary, to maintain a surveyable surface throughout the soil removal process. The water will be transferred to on-site tanks or equivalent and the water will be managed in accordance with the Waste Management Plan (TtEC, 2014b). Note that if any discrete item exceeding any of the release criteria is encountered in any lift, all of the soil removed and stockpiled will require further investigation prior to determining a final disposition. The method for radiological survey and sampling will be described in a separate TSP.

Once the limits of the excavations are reached as specified in the Technical Memorandum, Data Gaps Investigation for Sites 1 and 3, Site 2, and Site 7 (Tetra Tech, Inc., 2012), the final excavated soil surface (excavation bottom and sidewalls) will be surveyed as a Class 3 area using a Ludlum Model 2350-1 survey meter equipped with a Ludlum Model 44-10 2-inch by 2-inch NaI detector (or equivalent). MARSSIM guidance (DoD, et al., 2000) Table 2 indicates that scan surveys and sampling points should be based on professional judgment. As such, in the interest of conservatism, a 100 percent scan survey of the ground surfaces of the two removal area will be performed. Sampling will be performed as specified in this TSP. Based on the scan data, samples will be collected at areas exceeding the survey unit mean plus $3\sigma$, where $\sigma$ is the standard deviation of the gamma readings in the survey unit.

Upon receipt of the confirmation soil samples confirming that the release criteria has been achieved, excavation bottom and sidewall soil samples will be collected for cadmium analysis in accordance with the IR Site 7 Old Acid/Caustic Pit Sampling and Analysis Plan (TtEC, 2014c) to document existing conditions prior to backfilling with import material meeting the requirements specified in the IR Site 7 Old Acid/Caustic Pit Sampling and Analysis Plan (TtEC, 2014c).

In the event that no discrete items exceeding any release criteria are discovered through completion of the survey and excavation process, soil sampling of the five stockpiles may commence. For each of the five stockpiles of soil generated from the removal action, each not to exceed 500 cubic yards, two three-point composite soil samples will be collected and analyzed for the ROCs as specified in the Radiological Remediation/Assessment Sampling and Analysis Plan (TtEC, 2014d). The ten soil samples will be analyzed by gamma spectroscopy for Cs-137, Co-60, Ra-226, and Th-232. Soil samples will also be analyzed for Isotopic Uranium for U-238, Total Strontium for Sr-90, and liquid scintillation counting for H-3. All samples will be analyzed by a Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP) approved laboratory. If the soil data indicate contamination present above the levels specified in Table 2-1, the affected soil piles may undergo further radiological screening or be disposed as LLRW in consultation with the Navy.

After the stockpiles have been removed from the site, either transferred to Site 1/3 Landfill and/or transferred to the Navy's LLRW disposal contractor, the remainder of the site (approximately 5,061 square meters) will be surveyed as a Class 3 area. The soil (ground) surfaces will be surveyed using TtEC's RASO-approved vehicle towed array system and/or a Ludlum Model 2350-1 survey meter equipped with a Ludlum Model 44-10 2-inch by 2-inch NaI detector (or equivalent). MARSSIM guidance (DoD et al., 2000) Table 2 indicates that scan

surveys and sampling points should be based on professional judgment. As such, in the interest of conservatism, a 100 percent scan survey of the remaining ground surface of the site will be performed. Sampling will be performed as specified in this TSP. The 100 percent scan survey will be performed using the same methods previously described for the survey of the surface and repeated in Section 3.3 of this TSP.

## 3.0 SCOPING SURVEY DESCRIPTION

The Scoping Survey is being performed to assess whether residual activity (if present in the soil) has been removed to levels below the release criteria defined in Table 2-1. The Scoping Survey will be sufficient to be considered an FSS and recommend unrestricted radiological release of Site 7 if no residual contamination is detected in the soil survey units.

One hundred percent of the Class 3 soil survey units (SU) (SU 1 for the final excavation surface survey and SU 2 for the remainder of the site survey) will be scanned at a rate, not to exceed 0.5 meters per second using a Ludlum Model 2350-1 survey meter with a Ludlum Model 44-10 2-inch by 2-inch NaI detector and/or a RASO-approved drive-over-array system. Additional measurements and samples will be collected if investigation levels or release criteria are exceeded and identified during the review of data as determined by the RSOR. These areas will then be sampled using professional judgment. During the Class 3 soil survey activities, a minimum of 20 gamma static measurements and soil samples will be collected from each of the survey units. The locations of the two Class 3 survey units within Site 7 are provided on Figure A-2.

### 3.1 Release Criteria

This survey is being performed to assess whether residual activity above the established release criteria for soil or items excavated, as defined in Table 2-1, is present in the area.

### 3.2 Reference Area

Prior to performing the survey activities, a background reference area will be established for the Site 7 survey activities. A non-radiologically impacted soil background reference area with similar physical, chemical, geological, radiological, and biological characteristics as Site 7 soil will be selected. Material specific backgrounds will be determined in the event discrete items are excavated. Reference areas and material specific backgrounds will be chosen by the RSOR, in consultation with the Navy, and appropriate regulatory agencies. A minimum of twenty soil samples will be collected and analyzed for the gamma-emitting ROCs by a Department of Defense Environmental Laboratory Accreditation Program approved laboratory. A minimum of 10 percent of the soil samples will be analyzed for Isotopic Uranium, Total Strontium, and liquid scintillation counting for H-3

### 3.3 Investigation Level

For gamma surveys, the investigation level will be established at the survey unit mean plus 3σ, where σ is the standard deviation of the gamma readings in the survey unit. However, as a

starting point, areas will be marked (e.g., with flags) based on the mean of the reference area plus 3σ value. After a one hundred percent gamma scan of the area has been completed, the mean of the survey unit plus 3σ investigation value will be determined. Marked areas will be reassessed based on this value. At each sample location, a static measurement will be collected. Static measurements will be collected using a Ludlum Model 2350-1 survey meter equipped with a Ludlum Model 44-10 2-inch by 2-inch NaI detector (or equivalent). If the static reading exceeds the investigation level, the onsite RSOR will determine, based on the field conditions, whether further investigation is warranted. If site conditions (i.e., presence of material containing elevated concentrations of NORM) are ruled out as the likely source of the elevated gamma readings, the location will be excavated by hand to a maximum depth of one foot to determine whether a discrete item or significant radiological contamination in a concentrated area may be the cause of the comparatively elevated gamma reading. If a discrete item or item and/or soil that exhibit elevated gamma readings are present, the items and a minimum of 1 foot of soil on either side and below the discrete items and/or soils that exhibit elevated gamma readings will be removed as described in a specific Radiation Work Permit. The discrete item and/or soils that exhibit elevated gamma readings will be placed in an appropriate LLRW container for subsequent transfer to the Navy's LLRW disposal contractor. Post-remediation soil samples will be collected from the excavation sidewalls and bottom and of the removed soil if a discrete item is discovered. The excavated soil will be placed on plastic, spread out in a maximum 12-inch lift, resurveyed, and a biased soil sample will be collected from the area with the most elevated gamma readings. Any items removed from the soil will be surveyed in accordance with SOP 003, Release of Materials and Equipment from Radiologically Controlled Areas and analyzed in accordance with SOP 015, Use Of The Berkeley Nucleonics Corporation SAM-940-3G Radioisotope Identifier or an equivalent radioisotopic identifier. If no discrete item is located in an area exceeding the investigation level, a soil sample will be collected from the area with the most elevated gamma readings. The excavated ground surface will be resurveyed to confirm the remaining soil meets the investigation level. Survey area preparation activities will be performed under radiological controls established in the SOPs provided in the Basewide Radiological Management Plan (TtEC, 2014a). In the event any discrete item or soil sample result exceeds any release criteria, the survey operations will cease, the Navy will be notified, and the area will be re-classified as a Class 1 area. A separate TSP addressing remediation of radioactively contaminated soils and items with a subsequent Class 1 survey unit FSS will be developed and approved by the Navy prior to recommencing survey operations.

### 3.4 Gamma Scans

The surface area will be scanned with a RASO-approved drive-over array system or using a Ludlum Model 2350-1 survey meter with a Ludlum 44-10 2-inch by 2-inch NaI detector at a speed not to exceed 0.5 meters per second and will be operated in accordance with the Basewide Radiological Management Plan (TtEC, 2014a). Gamma scans of the surface area of the site will be logged and submitted with the final report.

### 3.5 Static Gamma Measurements

Static gamma measurements will be collected using professional judgment based on the gamma scan data using a Ludlum Model 2350-1 survey meter with a Ludlum 44-10 2-inch by 2-inch NaI

detector. The gamma and exposure rate measurements will be collected in accordance with SOP 001, Radiation and Contamination Surveys.

### 3.6 Exposure/Dose Rate Measurements

Prior to conducting any MARSSIM based surveys, a general area gamma exposure/dose rate survey will be conducted in accordance with SOP 001, Radiation and Contamination Surveys for safety and radiological posting purposes, as well as to identify any areas with comparatively elevated gamma exposure rates. If any area exceeds 50 μR/hr, the area will be posted as a Radiologically Controlled Area, the Navy will be notified, survey activities will cease, and the site will be re-classified as a Class 1 area. A separate TSP addressing remediation of radioactively contaminated soil and items with Class 1 surveys will be developed and approved by RASO prior to recommencing radiological survey activities. Ludlum Model 19, Bicron MicroRem, or equivalent, scintillation detectors will be used to perform the measurements. The measurements will be conducted with the instrument at approximately one meter from the ground surface.

### 3.7 Media Samples

Soil samples will be collected at sampling locations and analyzed by gamma and alpha spectroscopy, as well as liquid scintillation counting spectroscopy. One hundred percent of final soil samples will be analyzed by gamma spectroscopy. All samples will be analyzed by a Department of Defense ELAP approved laboratory. Ten percent of soil samples will be analyzed by Isotopic Uranium, Total Strontium, and liquid scintillation counting for H-3. All samples will be collected and analyzed in accordance with the Radiological Remediation/Assessment Sampling and Analysis Plan (TtEC, 2014d). Any discrete items removed during the soil sampling and survey activities that appear to be radioactive upon survey with a Ludlum 2350-1 survey meter coupled to a Ludlum 44-10 2-inch by 2-inch NaI detector will be surveyed in accordance with SOP 003, Release of Materials and Equipment and analyzed in accordance with SOP 015, Use Of The Berkeley Nucleonics Corporation SAM-940-3G Radioisotope Identifier.

Water samples of the containerized water generated from the dewatering of the excavations will be collected and analyzed for C0-60, Cs-137, H-3, Ra-226, Th-232, Total Strontium for Sr-90, and Isotopic Uranium for U-238. All water samples will be collected and analyzed in accordance with the Radiological Remediation/Assessment Sampling and Analysis Plan (TtEC, 2014d) and the IR Site 7 Old Acid/Caustic Pit Sampling and Analysis Plan (TtEC, 2014c). If the analytical data indicates exceedances of the investigation criteria in Table 2-1, the decontamination water will be turned over to the Navy's LLRW disposal contractor; otherwise, the water will be disposed of at an approved disposal facility in accordance with the Waste Management Plan (TtEC, 2014b).

### 3.8 Dose Modeling in Support for Unrestricted Release

The intent of the Site 7 Scoping Survey is to achieve the requirements of an FSS and demonstrate that the site is not radiologically impacted. In the event that no release criteria exceedances are observed during the performance of the survey and sampling activities detailed

in this TSP, the Scoping Survey will be documented as a MARSSIM Class 3 FSS and will establish that Site 7 is not radiologically impacted and is therefore radiologically free released. If any release criteria exceedances are noted for the ROCs, the radiological data will be assessed to determine whether the concentrations for the ROCs are indistinguishable from background. This may be accomplished for soil by demonstrating that the survey unit soil ROC sample concentrations are indistinguishable from the corresponding reference area ROC concentrations through statistical analysis using scenario B from NUREG-1505 (NRC 1998). In addition, dose and risk modeling of Site 7 using the soil analytical results will be performed and documented in the final report. If release criteria are exceeded for any soil samples and indistinguishability from background cannot be established through statistical analysis or radioactive materials were removed, additional remedial actions and surveys may be necessary.

## 4.0 QUALITY CONTROL

The data quality objectives for the survey and sampling activities are provided in Table 4-1.

Definable features of work (DFWs) establish the measures required to verify both the quality of work performed and compliance with project requirements. The DFWs and associated phases of quality control for vegetation clearing, geophysical surveys, radiological surveys, remediation of radioactive contamination, import soil sampling, and site restoration are provided in Table 3-1 of the Contractor Quality Control Plan (TtEC, 2014e).

## 5.0 ENVIRONMENTAL PROTECTION

The environmental protection-driven requirements have been addressed in the Environmental Protection Plan (TtEC, 2014f) and the Stormwater Pollution Prevention Plan (TtEC, 2014g). No additional requirements are necessary.

## 6.0 REFERENCES

DoD (Department of Defense), Department of Energy, Nuclear Regulatory Commission, and U.S. Environmental Protection Agency. 2000. Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), NUREG-1575, Revision 1. August.

NAVSEA (Naval Sea Systems Command.). 2014. Final Historical Radiological Assessment, History of the Use of General Radioactive Materials 1943 to 2011. March.

NRC (Nuclear Regulatory Commission). 1998. A Nonparametric Statistical Methodology for the Design and Analysis of Final Status Decommissioning Surveys, NUREG-1505, Revision 1. June.

TtEC (Tetra Tech EC, Inc.). 2014a. Basewide Radiological Management Plan, Former Naval Air Station Brunswick, Brunswick, Maine. In Progress.

TtEC. 2013. Accident Prevention Plan/Site Safety and Health Plan, Former Naval Air Station Brunswick, Brunswick, Maine. In Progress

TtEC. 2014b. Waste Management Plan, Former Naval Air Station Brunswick, Brunswick, Maine. In Progress.

TtEC. 2014c. Sampling and Analysis Plan, IR Site 7 Old Acid/Caustic Pit, Former Naval Air Station Brunswick, Brunswick, Maine. In progress.

TtEC. 2014d. Sampling and Analysis Plan, Radiological Remediation/Assessment, Former Naval Air Station Brunswick, Brunswick, Maine. In progress.

TtEC. 2014e. Contractor Quality Control Plan, Former Naval Air Station Brunswick, Brunswick, Maine. In Progress.

TtEC. 2014f. Environmental Protection Plan, Former Naval Air Station Brunswick, Brunswick, Maine. In Progress.

TtEC. 2014g. Stormwater Pollution Prevention Plan, Former Naval Air Station Brunswick, Brunswick, Maine. In Progress.

Tetra Tech, Inc. 2012. Technical Memorandum, Data Gap Investigations for Sites 1 and 3, Site 2, and Site 7, Former Naval Air Station Brunswick, Brunswick, Maine. May.

This page intentionally left blank.

# TABLES

This page intentionally left blank.

**TABLE 2-1**
**SITE 7**
**PRIMARY RADIATION PROPERTIES AND RELEASE CRITERIA**
**FOR RADIONUCLIDES OF CONCERN**

| Radio nuclide | Primary Radiation Properties | | Release Criteria | | | |
|---|---|---|---|---|---|---|
| | | | Materials, Equipment, and Wastes | | | |
| | Half-life | Type | Total Surface Activity (dpm/100 $cm^2$) | Removable Activity (dpm/100 $cm^2$) | Soil Samples (pCi/g)[a] | Water Samples (pCi/L)[c] |
| Co-60 | 5.27 years | Beta | 5,000 | 1,000 | 2.28 | 100 |
| Cs-137 | 3.01E01 years | Beta | 5,000 | 1,000 | 6.6 | 119 |
| H-3 | 1.23E01 years | Beta | 5,000 | 1,000 | 66 | 20,000 |
| Ra-226 | 1.6E03 years | Alpha | 100 | 20 | 1.0 | 5[d] |
| Sr-90 | 2.86E01 years | Beta | 1,000 | 200 | 1.02[b] | 8 |
| Th-232 | 1.41E10 years | Alpha | 1,000 | 200 | 0.66 | 15 |
| U-238 | 4.47E09 years | Alpha/Beta | 5,000 | 1,000 | 8.4 | 30 |

***Notes:***

[a] Criteria is above background for those radionuclides found in background soils.

[b] Total Strontium analysis is the analytical method used to conservatively quantify Sr-90 concentration.

c Investigation criteria for water have been derived from *Radionuclides Notice of Data Availability Technical Document* (EPA 2000) Table III, which compared the federal drinking water standards from the 1976 and 1991 Maximum Contaminant Levels. This value reflects the most conservative limit.

d Limit is for total Radium Concentration.

***Abbreviations and Acronyms:***

Co-60 – Cobalt-60
Cs-137 – Cesium-137
$cm^2$ - square centimeters
dpm - disintegration per minute
H-3 – Tritium
pCi/g picocurie per gram
pCi/L picocuries per liter
Ra-226 – Radium-226
Sr-90 – Strontium-90
Th-232 – Thorium-232
U-238 – Uranium-238

## TABLE 4-1
## SUMMARY OF DATA QUALITY OBJECTIVES

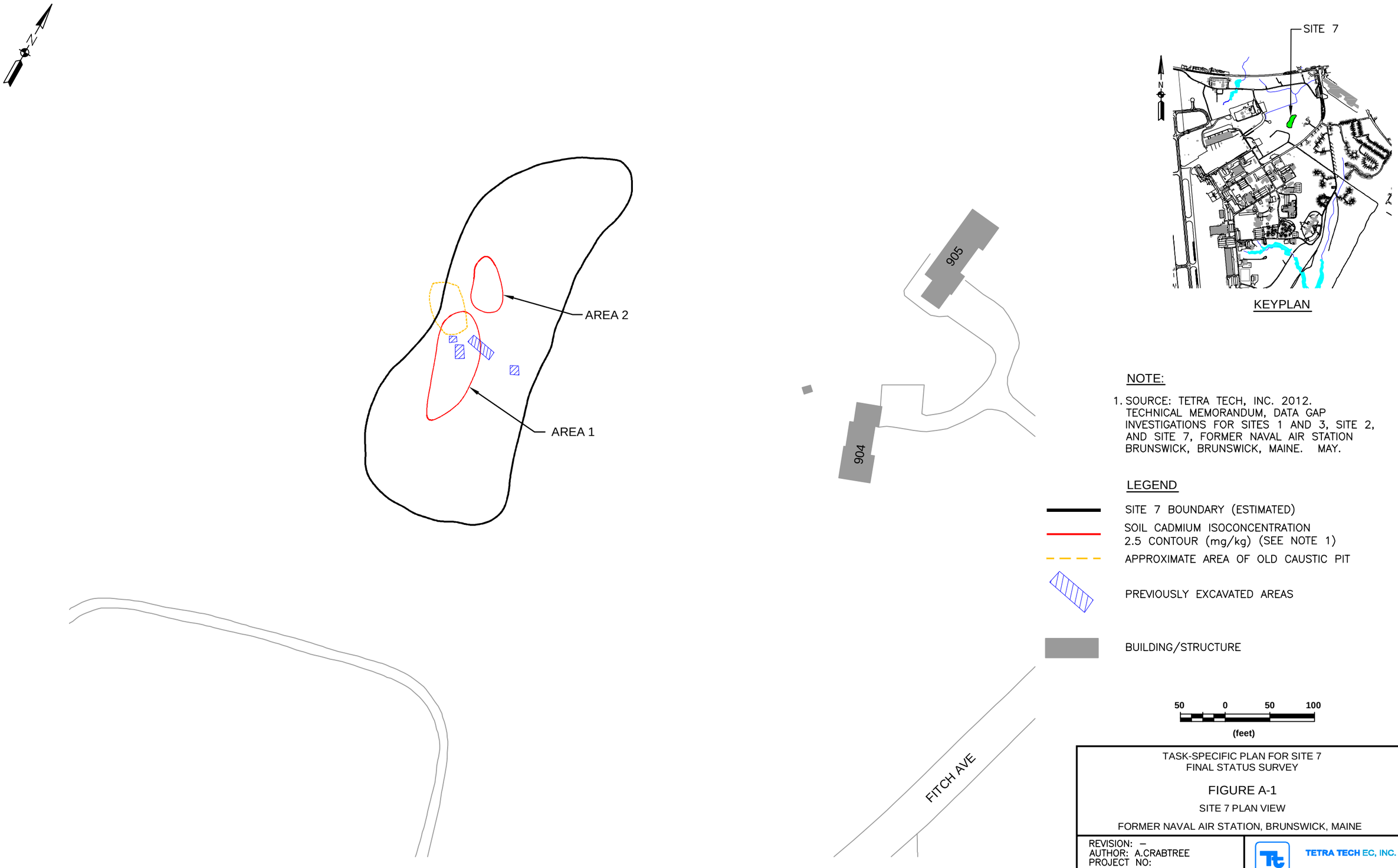
| STEP 1 | STEP 2 | STEP 3 | STEP 4 | STEP 5 | STEP 6 | STEP 7 |
|---|---|---|---|---|---|---|
| **State the Problem** | **Identify the Goal of the Study** | **Identify Information Inputs** | **Define the Boundaries of the Study** | **Develop the Analytical Approach** | **Specify Performance or Acceptance Criteria** | **Develop the Plan for Obtaining Data** |
| Site 7 is designated as a radiologically impacted site in the HRA. The radionuclides of concern are Co-60, Cs-137, H-3, Ra-226, Sr-90, Th-232, and U-238. It must be determined if the site-specific release criteria for these radionuclides have been met or if remediation is warranted. | The primary use of the data expected to result from completion of this TSP is to support the Final Status Survey of Site 7. Therefore, the decision to be made can be stated as "Do the results of the survey meet the release criteria?" | Radiological surveys required to support the Final Status Survey of the Site 7 will include:<br>• 100 percent gamma scan surveys of the Class 3 survey units using a RASO-approved drive-over array mechanism and/or hand-held instrumentation on soil (ground) surfaces<br>• A minimum of 20 gamma static measurements and soil samples in the Class 3 (ground) survey units<br>• Additional measurements and samples to be collected if investigation levels are exceeded during review of the associated scan data | The lateral and vertical spatial boundaries for this survey effort are confined to the Site 7 as shown on the figures in Appendix A. | If the results of the survey meet the release criteria, then the data will be used to support a Final Status Survey. Otherwise, the data will be used for characterization. | Limits on decision errors are set at 5 percent as specified in the Basewide Radiological Management Plan (TtEC, 2014a). | Operation details for the radiological survey process have been developed. The theoretical assumptions are based on guidelines contained in MARSSIM (DoD et al. 2000). Specific assumptions regarding types of radiation measurements, instrument detection capabilities, quantities and locations of data to be collected, and investigation levels are contained in this TSP and the Basewide Radiological Management Plan (TtEC, 2014a). |

***Abbreviations and Acronyms:***
Co – Cobalt-60
Cs-137 – Cesium-137
H-3 - Tritium
HRA – Historical Radiological Assessment
MARSSIM – Multi-Agency Radiation Survey and Site Investigation Manual
Ra-226 – Radium-226
Sr-90 – Strontium-90
Th-232 – Thorium-232
TSP – Task-specific Plan
U-238 – Uranium-238

# APPENDIX A

# FIGURES FOR SITE 7 SURVEYS

This page intentionally left blank.




TASK-SPECIFIC PLAN FOR SITE 7
FINAL STATUS SURVEY

FIGURE A-1

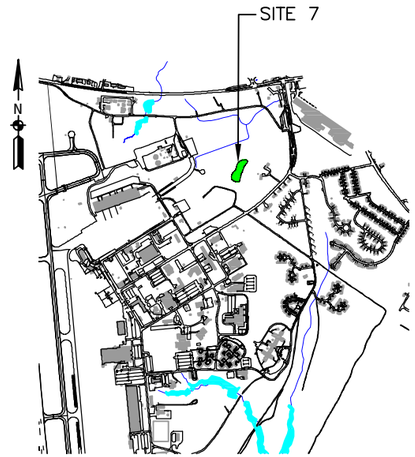
SITE 7 PLAN VIEW

FORMER NAVAL AIR STATION, BRUNSWICK, MAINE

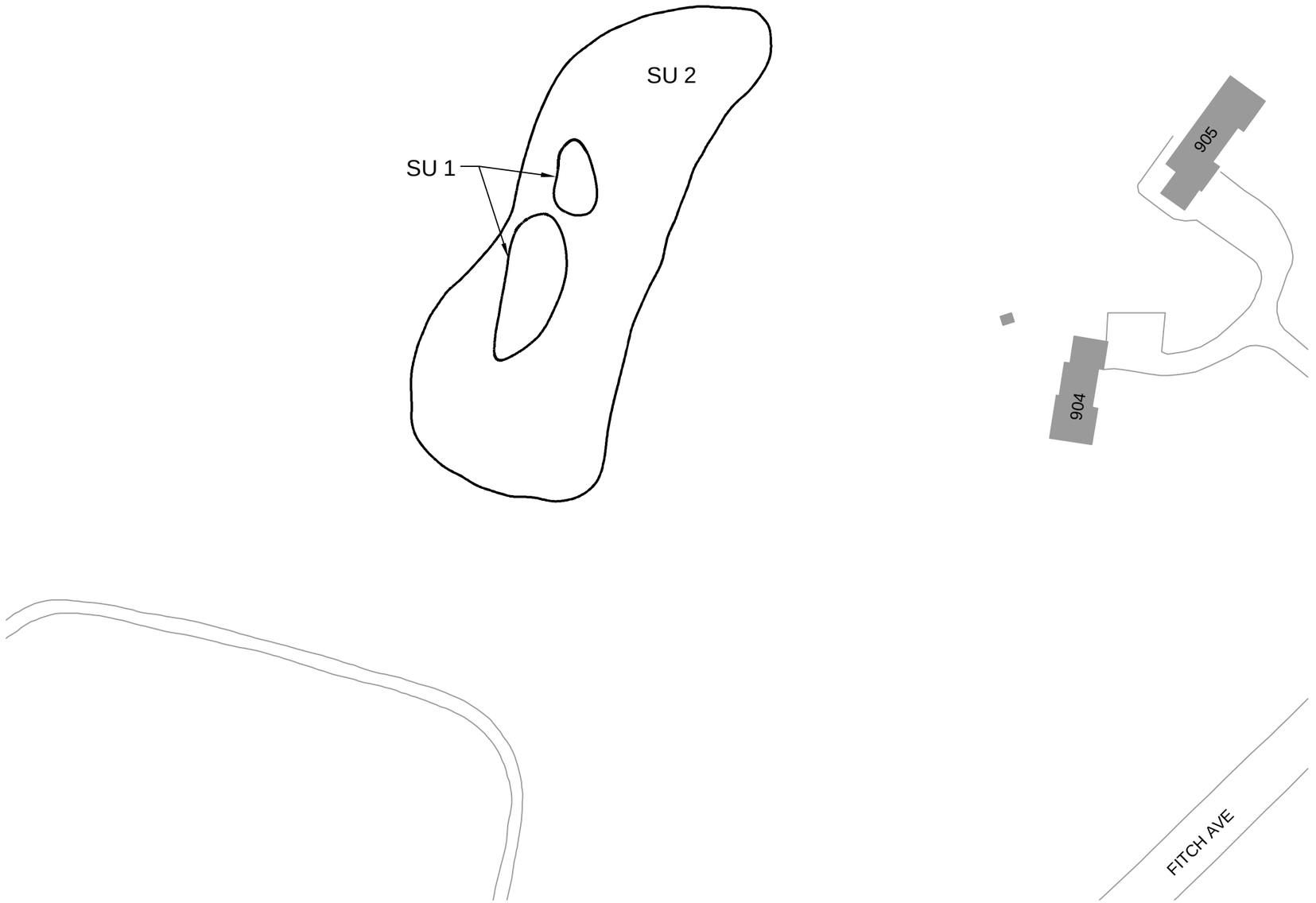
REVISION: –
AUTHOR: A.CRABTREE
PROJECT NO:
FILE: SEE BELOW

TETRA TECH EC, INC.

P:\CAD Project Files\NAS Brunswick\DWG Files\Brunswick_Site 7_Figure A-1_05-14-14.dwg




KEYPLAN




LEGEND

SU 1 SURVEY UNIT DESIGNATION

SURVEY UNIT BOUNDARY

BUILDING/STRUCTURE

NOTE:

SU 1 COMPRISED OF AREAS 1 AND 2 SHOWN ON FIGURE A–1. SU 2 IS REMAINDER OF SITE 7

50 0 50 100

(feet)

TASK-SPECIFIC PLAN FOR SITE 7
FINAL STATUS SURVEY

FIGURE A-2

SITE 7 CLASS 3 SURVEY UNITS

FORMER NAVAL AIR STATION, BRUNSWICK, MAINE

REVISION: –
AUTHOR: A.CRABTREE
PROJECT NO:
FILE: SEE BELOW

TETRA TECH EC, INC.

P:\CAD Project Files\NAS Brunswick\DWG Files\Brunswick_Site 7_Figure A-2_03-13-14.dwg